

### **REMARKS**

Applicants appreciate the thorough examination of the present application as evidenced by the Office Action mailed October 18, 2007 (hereinafter "Office Action").

### **Status of the Claims**

Claims 1, 4-6, 8, and 13 stand rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kirkham U.S. Patent No. 4,582,637 to Kirkham (hereinafter "Kirkham"). Claims 3, 7, and 9-12 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kirkham in view of U.S. Patent No. 4,416,810 to Noakes (hereinafter "Noakes"). Claims 1, 4-6, 8 and 13 stand rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 5,946,639 to Hess (hereinafter "Hess"). Claims 3, 7 and 9-12 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hess in view of Noakes.

### **The Rejections under Sections 102 and 103**

Claim 1 recites:

A method for the encapsulation of a nuclear material comprising:  
treating the nuclear material with an encapsulant which comprises a cementitious material; and  
curing said cementitious material;  
wherein said nuclear material comprises uranium metal, Magnox fuel elements or fuel element debris."

Claim 13 recites:

A method of storing a nuclear material comprising:  
encapsulating the nuclear material in a cured cementitious material, wherein said nuclear material comprises uranium metal, Magnox fuel elements, and/or fuel element debris.

Thus, the claims are particularly focused on the encapsulation of a nuclear material which comprises uranium metal, Magnox fuel elements or fuel element debris. Applicants respectfully submit that this provides a key distinguishing feature *vis-à-vis* the cited art.

Regarding the rejections over Kirkham, Kirkham is directed towards the treatment of radioactive effluent by producing a floc that comprises a suspension of precipitates carrying radioactive species in a mother liquor containing dissolved non-radioactive salts, washing the floc with water in order to displace the mother liquor containing the dissolved non-radioactive salts, and then encapsulating the floc in a solid matrix by treatment with bitumen, cement, and the like. The water washing treatment prior to encapsulation in the solid matrix is claimed to reduce the final amount of solidified radioactive waste, hence providing consequent advantages in the storage and disposal thereof.

It can be seen from Kirkham, most particularly the paragraph at column 1, lines 22-56, that the disclosed treatment process requires the treatment of intermediate level waste so as to produce a floc that retains the radioactivity, the treatment typically including the consecutive formation of precipitates of a ferrocyanide, hydroxides, barium sulphate, and a sulphide. The intermediate level waste may, for example, be generated as a result of the reprocessing of irradiated Magnox fuel, which comprises uranium metal fuel encapsulated in magnesium alloy (Magnox) cans. Alternatively the waste may include sludges and ion-exchange resins which result from storage and in-pond corrosion of the irradiated fuel in the storage ponds at reactor sites and reprocessing sites, or may comprise pieces of the magnesium alloy cans which have been stripped from the irradiated uranium metal fuel. The floc generated by treatment of these waste materials may then be subjected to encapsulation treatment.

Applicants respectfully submit that this treatment as disclosed in Kirkham is far removed from that of the presently claimed invention, wherein uranium metal, Magnox fuel elements or fuel element debris are subjected to an encapsulation treatment. Thus, the claimed invention is directed to the encapsulation of uranium metal and spent nuclear fuel, which may be referred to as Magnox fuel in view of the Magnox (magnesium/aluminium alloy) material used to clad the fuel. However, the spent fuel actually contains at most small residual quantities of "Magnox." The present invention, therefore, is concerned with the encapsulation of uranium metal and spent fuel, rather than the encapsulation of a floc which has been produced by treatment of intermediate level waste and then subjected to an aqueous

washing treatment. Consequently, it is believed that the process defined in Claim 1 of the present application clearly shows novelty over Kirkham.

Applicants further submit that the invention as claimed would not have been obvious to one of ordinary skill in the art in view of Kirkham alone or in view of the other cited art. The considerations for an encapsulation treatment intended to be applied to the treatment of uranium metal or spent nuclear fuel must clearly be far different to those relevant to the encapsulation of a floc of the type discussed by Kirkham and, in the circumstances, it is not seen that the process of the claimed invention can be considered to be obvious in the light of the teaching of Kirkham. Clearly, it could not be predicted that the presently claimed method would be successfully applied to the encapsulation of uranium metal or spent nuclear fuel on the basis of a method which is intended for the treatment of quite different materials and, therefore, the subject matter of Claim 1 is believed to show inventive step over Kirkham.

Noakes is directed towards a method for the encapsulation in a cement mixture of organic liquid radioactive waste comprising an aromatic liquid and an organic fluor, generated from the use of liquid scintillation counting. Consequently, it is again apparent that the material being treated is completely different from the uranium metal, Magnox fuel elements and fuel element debris specified in the first claim of the present application. Thus, Noakes, which is cited in combination with Kirkham in support of the rejections of certain of the dependent claims, does not satisfy the deficiencies of Kirkham as described above. In particular, as discussed above, the teaching of Kirkham is so far removed from the subject matter of the present application that there is nothing that Noakes can add which would render the claimed invention obvious.

Hess discloses a method for treating ignitable cutting swarf which involves collecting the swarf in a casting mould underwater, injecting a binder mixture comprising vinyl ester styrene into the vessel to fill the void, and curing the resulting mixture. The method of Hess is said to be especially useful for stabilizing the ignitable characteristics of radioactive zirconium cutting swarf, and can be used to solidify zirconium swarf, or other ignitable finely divided material, underwater. However, Hess also teaches that the process can be performed out of water with other particulate wastes, and specific reference is made to the encapsulation of magnesium swarf, generated when mechanically stripping off Magnox fuel cladding (column 2, lines 19-22). Again, however, the treatment of magnesium swarf represents a completely different situation to the treatment of uranium metal, Magnox fuel elements or

fuel element debris, which is the concern of the claimed invention. Consequently, Applicants respectfully submit that Hess is not particularly pertinent to the novelty of the subject matter of Claim 1.

Furthermore, although Hess does make mention of the use of hydraulic cement, instead of cured vinyl ester styrene, as a solidification binder, the author actually discusses the disadvantages of such materials, and previous efforts to find preferable alternatives (column 2, line 42-column 3, line 56), before going on to comment that it is preferred that the claimed invention does not use cement (column 4, lines 38-39). Thus, far from motivating the skilled person to arrive at the claimed invention, Hess seems to point in the other direction completely on occasions. Accordingly, Applicants respectfully submit that the claimed invention is thus further nonobvious in view of this aspect of Hess.

Thus, it is seen that the cited art which refers to encapsulation of Magnox material is concerned with swarf or sludge derived from this material that has been essentially separated from the uranium fuel, either intentionally or adventitiously, and will, as a consequence, contain – at the most – minimal quantities of uranium metal, Magnox fuel elements or fuel element debris. Clearly, the chemical and physical properties of these materials are so far removed from those of the swarf or sludge discussed in the prior art as to make the presently claimed invention far from obvious.

## CONCLUSION

In light of the above amendments and remarks, Applicants respectfully submit that the above-entitled application is now in condition for allowance. Favorable reconsideration of this application, as amended, is respectfully requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (919) 854-1400.

Respectfully submitted,



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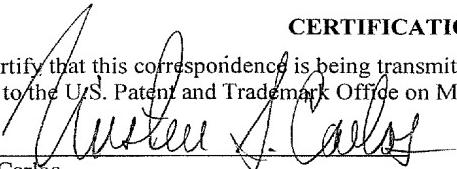
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**CERTIFICATION OF TRANSMISSION**

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on March 13, 2008.

  
Kirsten S. Carlos